Dam Optimization

use dams more effectively and efficiently

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Noriyuki MORI

Senior Water Resources Specialist

(Dam Optimization)

SDCC-WAT

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Outline

- Background
- Measures for Water Resources Management
- Needs of Dam Optimization
- Methodology of Dam Optimization
- Good Practices of Dam Optimization
- Discussion

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Background

【Climate Change】
- ✓ More Intense Rainfall
- ✓ Less Rainfall or Snowfall

【Population and Economic Growth】
- ✓ Water Demand Increase for Food, Domestic, Industry, Energy…..

【Urbanization】
- ✓ More Population and Asset in Urban area

Flood Disaster Risk

Water Demand-Supply Gap
- ✓ Irrigation
- ✓ Water Supply
- ✓ Industry
- ✓ Hydropower ……

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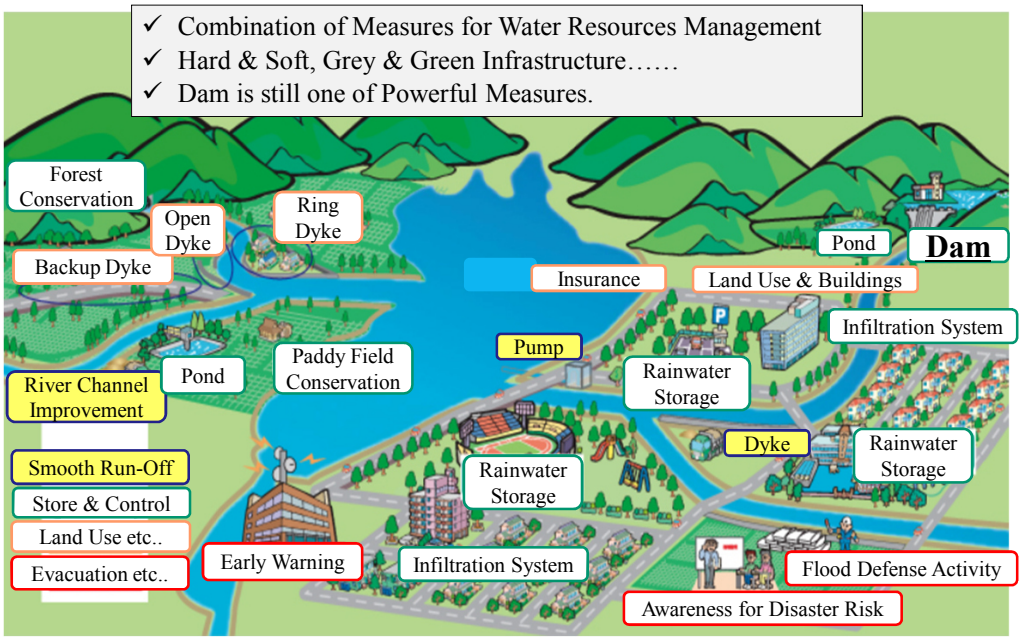
Measures for Water Resources Management

- ✓ Combination of Measures for Water Resources Management
- ✓ Hard & Soft, Grey & Green Infrastructure……
- ✓ Dam is still one of Powerful Measures.



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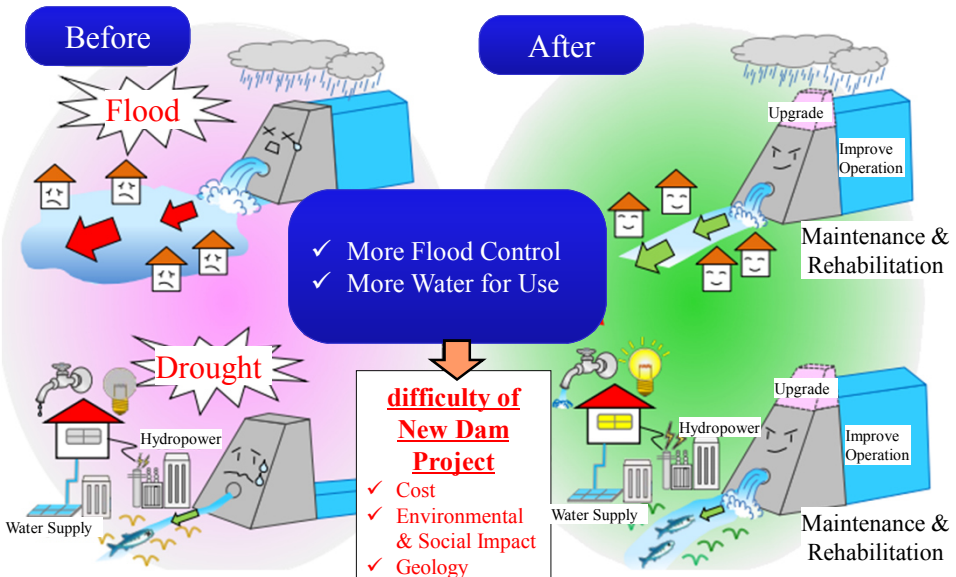
Needs of Dam Optimization



- ✓ More Flood Control
- ✓ More Water for Use

difficulty of New Dam Project

- ✓ Cost
- ✓ Environmental & Social Impact
- ✓ Geology
- ✓ Topography ….

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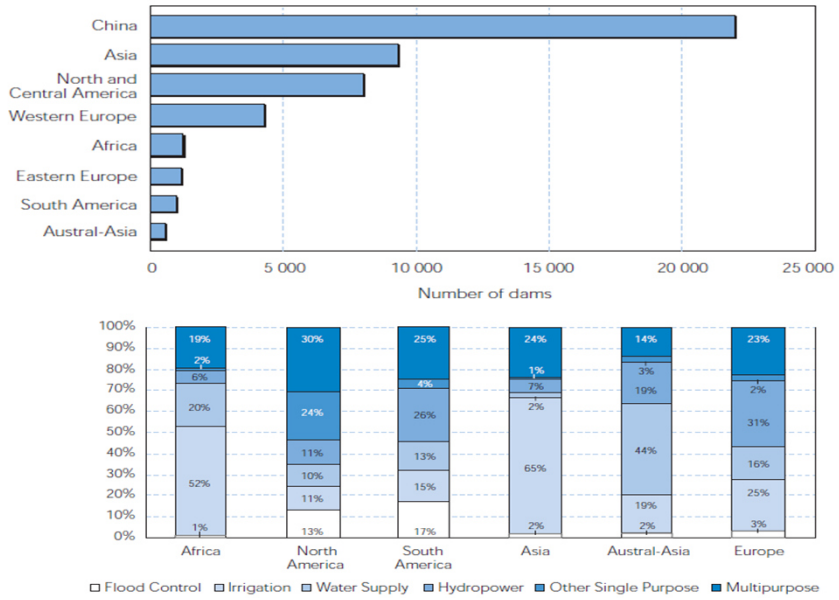
Needs of Dam Optimization



Source: DAMS AND DEVELOPMENT, The Report OF The WORLD COMMISSION ON DAMS (WCD), Nov.2000

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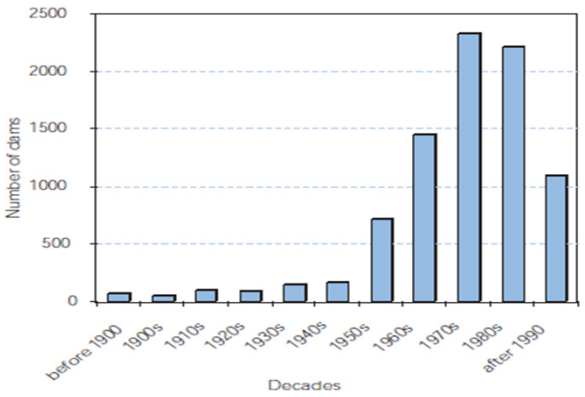
Needs of Dam Optimization

Large dams commissioned per decade in Asia*

- ✓ 1970s – 1980s was the peak of dam projects.
- ✓ More than Half of Dams are over 40 years old.
- ✓ Maintenance and Rehabilitation is necessary.



*Excluding China

Source: DAMS AND DEVELOPMENT, The Report OF The WORLD COMMISSION ON DAMS (WCD), Nov.2000

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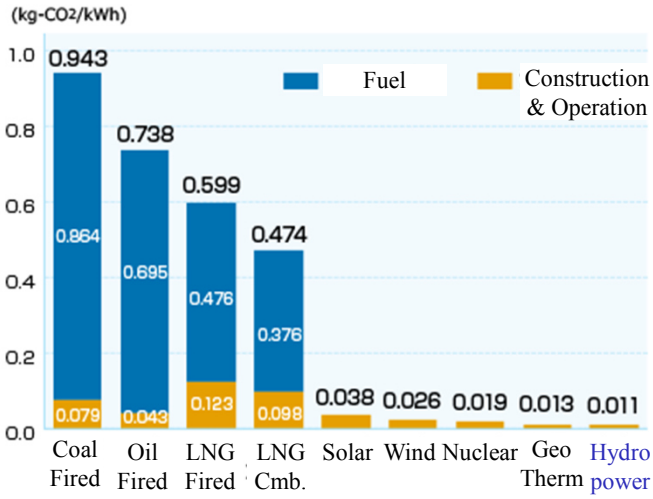
Needs of Dam Optimization

CO2 Emission by Power Generation



Source: Report of Central Research Institute of Electric Power Industry Japan, July 2016

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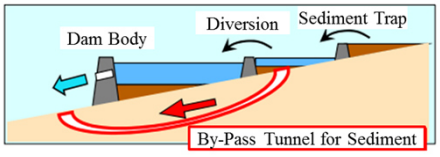
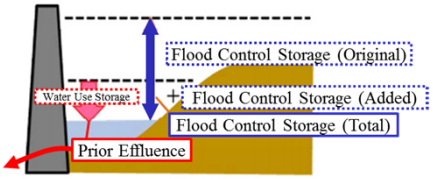
Methodology of Dams Optimization

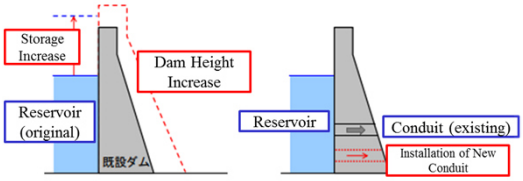
【Use Dam as Long as Possible】
- ✓ Appropriate Maintenance and Rehabilitation
- ✓ Sediment Management in Dam Reservoir



【Use Dam Capacity Effectively】
- ✓ Reallocate Dam Reservoir Capacity
- ✓ Revise Dam Operation Rule



【Strengthen Dam Function】
- ✓ Increase Dam Height for more Storage Capacity
- ✓ Increase Dam Discharge Capacity for Flood Control etc.



【Networking of Dams】
- ✓ Connect Dam Reservoirs
- ✓ Use Dams in a River Basin as Network

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Use Dam as Long as Possible / Maintenance and Rehabilitation

Risk Mitigation and Strengthening of Endangered Reservoirs in Shandong Province Project in PRC Funded by ADB

From 2011 to 2016
Cost: US$ 25.17 million

Outcome:
- ✓ Sustainable rehabilitation and management of reservoirs

Output:
- ✓ Rehabilitation of model reservoirs (total 7 reservoirs)
- ✓ Establishment of sustainable reservoir rehabilitation and management Models
- ✓ Project management support

Source: Completion Report, Sep. 2017, Risk Mitigation and Strengthening of Endangered Reservoirs in Shandong Province Project

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Use Dam as Long as Possible / Sediment Management

Miwa Dam (1958-)

- ✓ Concrete Gravity Dam (F, P)
  - Flood: 13.40 million m3
  - Power: 10.35 million m3
  - Sediment: **6.59 million m3**
- ✓ Sediment Management
  6 million m3 of Cumulate Sediment (1958-2000)

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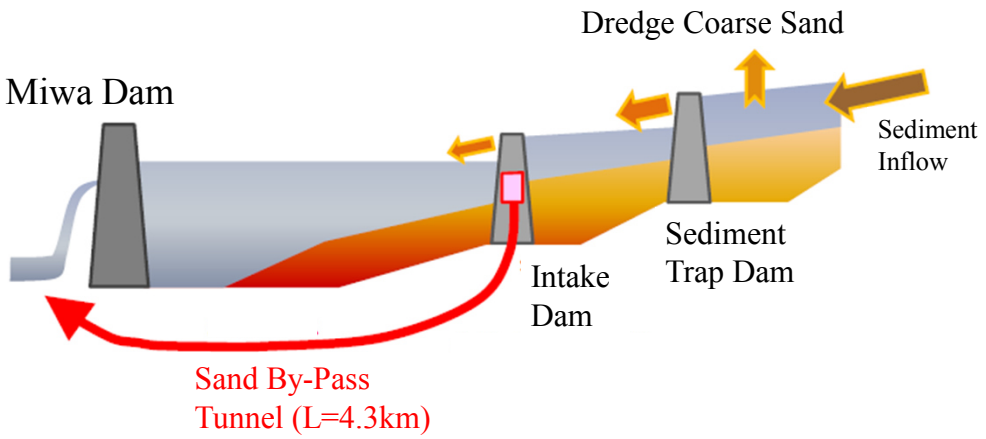
Use Dam as Long as Possible / Sediment Management

Miwa Dam



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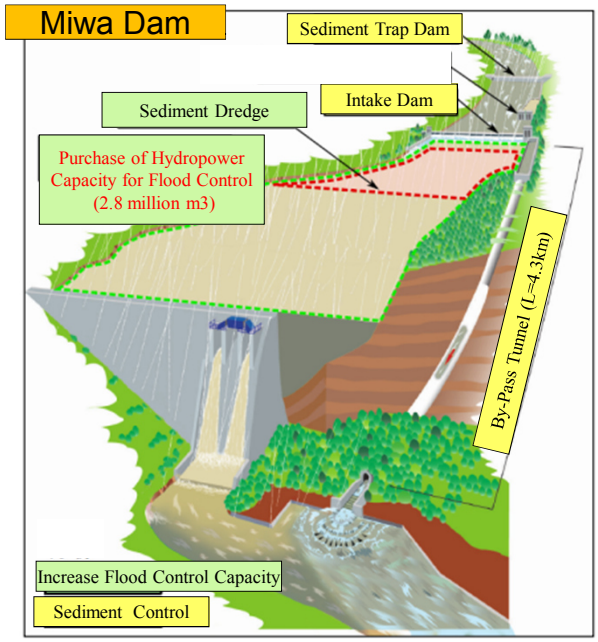
Use Dam as Long as Possible / Sediment Management

Miwa Dam



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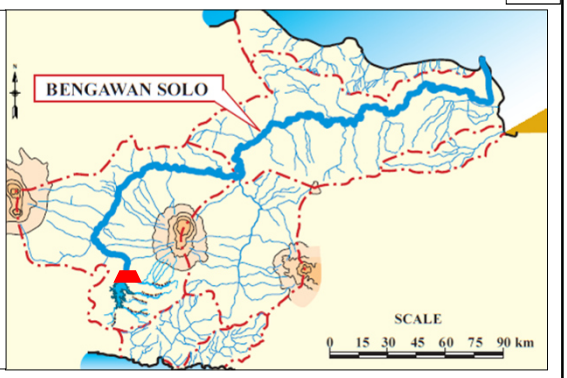
Use Dam as Long as Possible / Sediment Management

Wonogiri Dam (1981-)

- ✓ Rock Fill Dam (F,A,P)
  - Flood: 220 million m3
  - Agri, Power: 395 million m3
  - Sediment: **120 million m3**
- ✓ Sediment Management
  - ➢ **114 million m3** of Cumulate Sediment (1981-2005)



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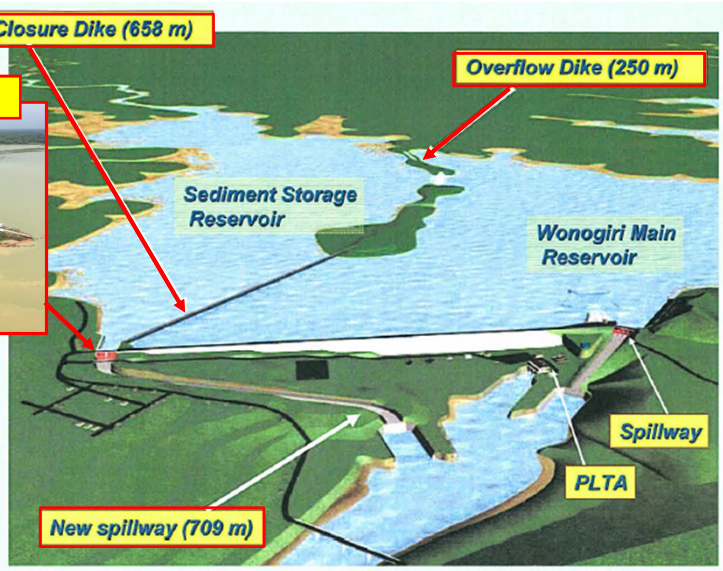
Use Dam as Long as Possible / Sediment Management

Wonogiri Dam

New Sediment Gate

JPY Loan Project
11 billion JPY
(100 million USD)



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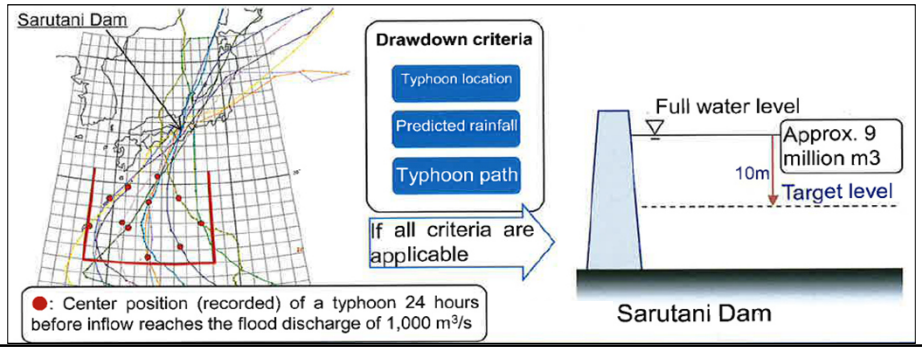
Use Dam Capacity Effectively / Revise Dam Operation Rule

Sarutani Dam (1957-)

- ✓ Concrete Gravity Dam (N,P)
  Normal Flow, Power: 17.3 million m3
  Sediment: 6.0 million m3
- ✓ **Flood Disaster** by Typhoon **in 2011** in the Kinokawa River Basin

↓

- ✓ Start an Ex-Ante Discharge Operation from 2012
- ✓ Flood Control Capacity of Approx. 9 million m3 by the operation



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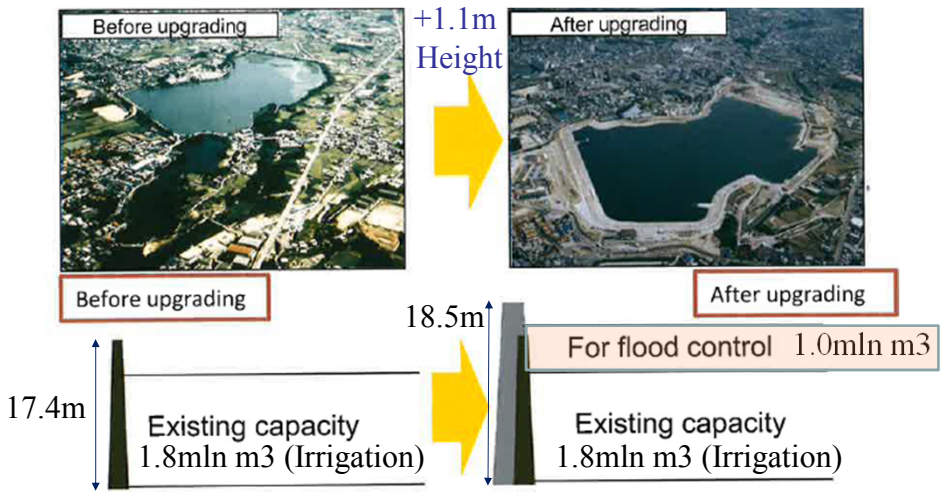
Strengthen Dam Function / Increase Dam Height

Sayama-Ike Dam (600s-)

Dam Heightening for Flood Control

of the oldest dam in Japan (approx.1400 years old)



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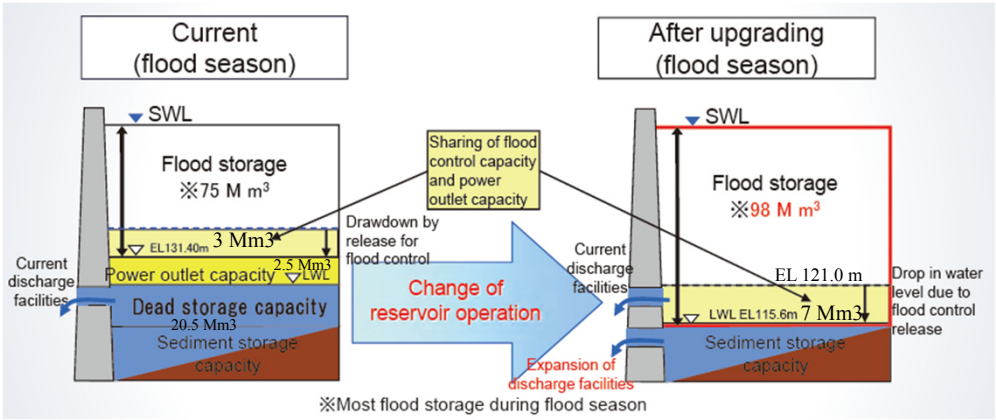
Strengthen Dam Function / Increase Dam Discharge Capacity

Tsuruda Dam (1965-)

- ✓ Large-Scale Flood Disaster in the Sendai-gawa River Basin in July 2006
- ✓ Discussion and Consensus-Building among stakeholders (Residents, Local Governments, Water Users including Power Company, NGOs, ….) in the River Basin.
- ✓ Preparation of River Management Plan of Sendai-gawa, including Tsuruda Dam Upgrading Project in July 2009.



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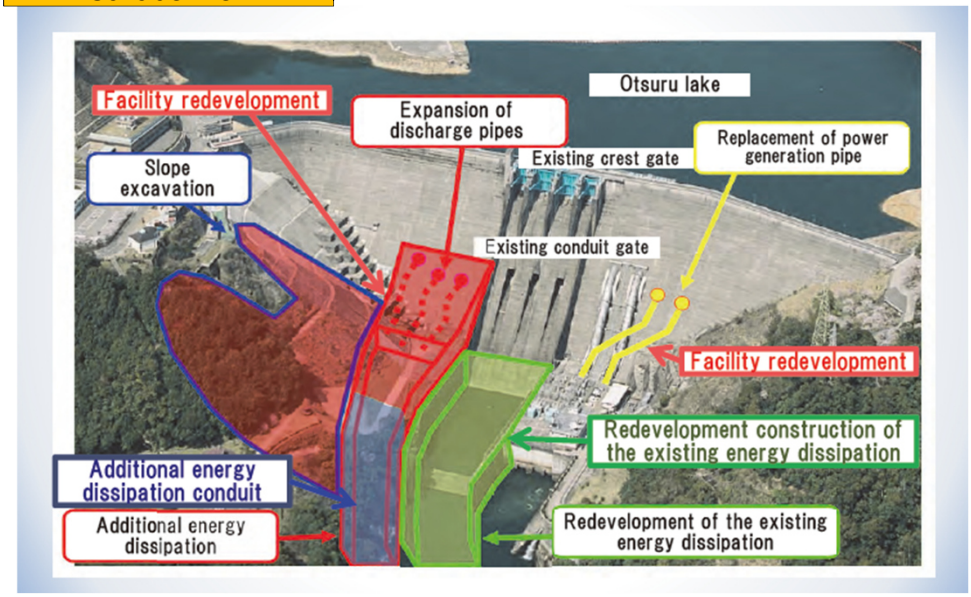
Strengthen Dam Function / Increase Dam Discharge Capacity

Tsuruda Dam



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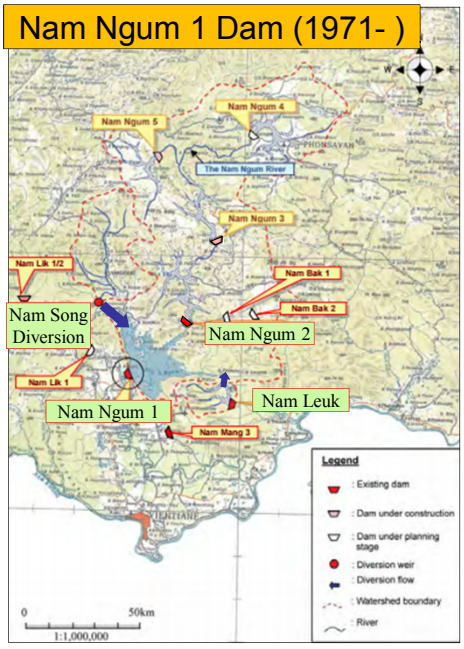
Strengthen Dam Function /Increase Dam Discharge Capacity

Nam Ngum 1 Dam (1971-)



Development of Nam Gum River Basin

1971: Nam Ngum 1 Hydropower
(JICA, WB, etc.)

1996: Nam Song Diversion to Nam Ngum
(ADB)

2000: Nam Leuk Hydropower
with diversion to Nam Ngum
(ADB, JBIC)

2011: Nam Ngum 2 Hydropower
(IPP NN2PC)

2013: Nam Ngum 1 Hydropower Expansion
Loan Agreement (JICA)

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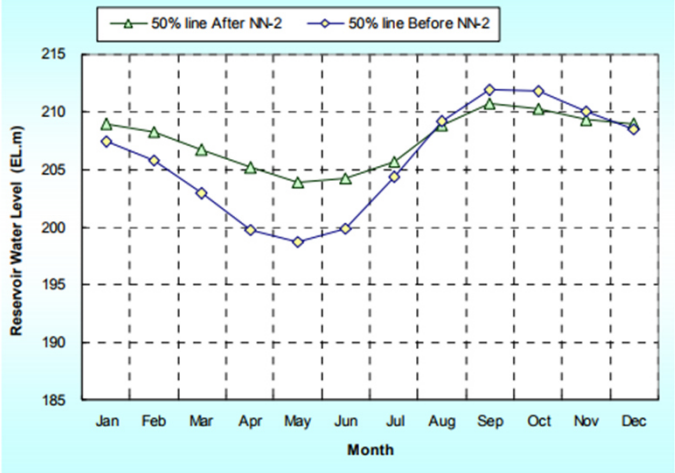
Strengthen Dam Function /Increase Dam Discharge Capacity

Nam Ngum 1 Dam

Reservoir Water Level, before and after Num Ngum 2 Hydropower



Source: JICA Survey team

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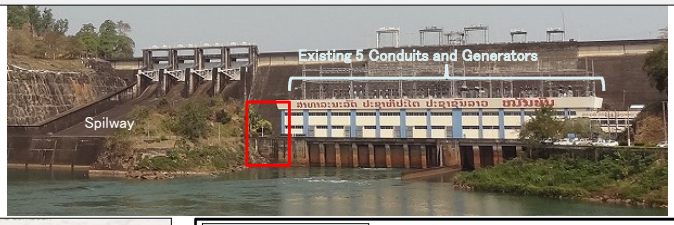
Strengthen Dam Function /Increase Dam Discharge Capacity

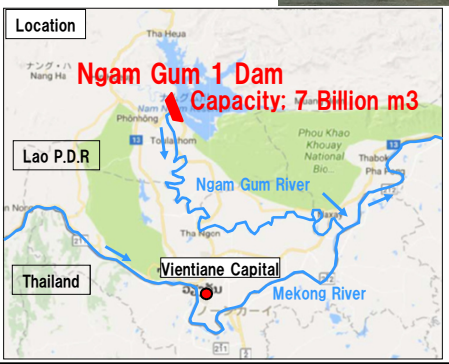
Nam Ngum 1 Dam

Expansion of Generator and Conduits: 5 (155MW) → 6 (195MW)

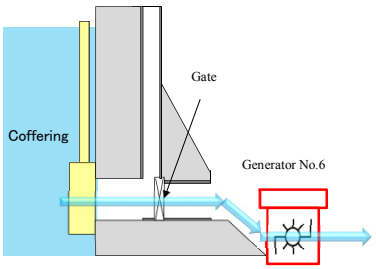
JPY Loan Project
6 billion JPY
(55 million USD)



Location



Cross Section Image



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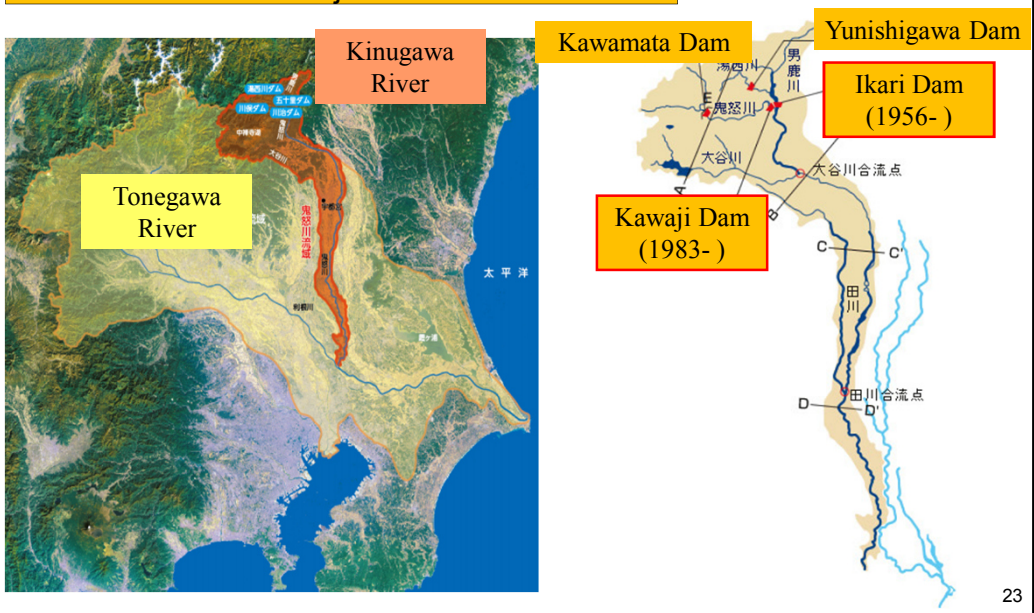
Networking of Dams / Connect Dam Reservoirs

Connection of Kawaji Dam and Ikari Dam



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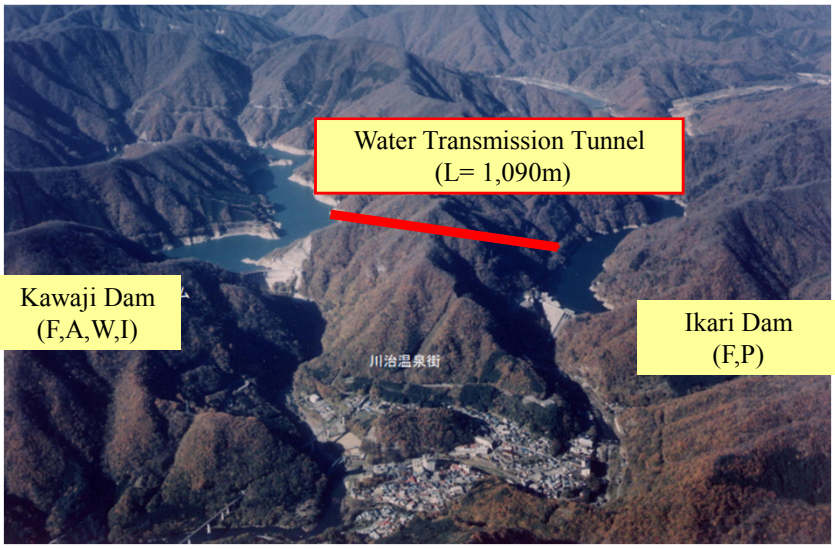

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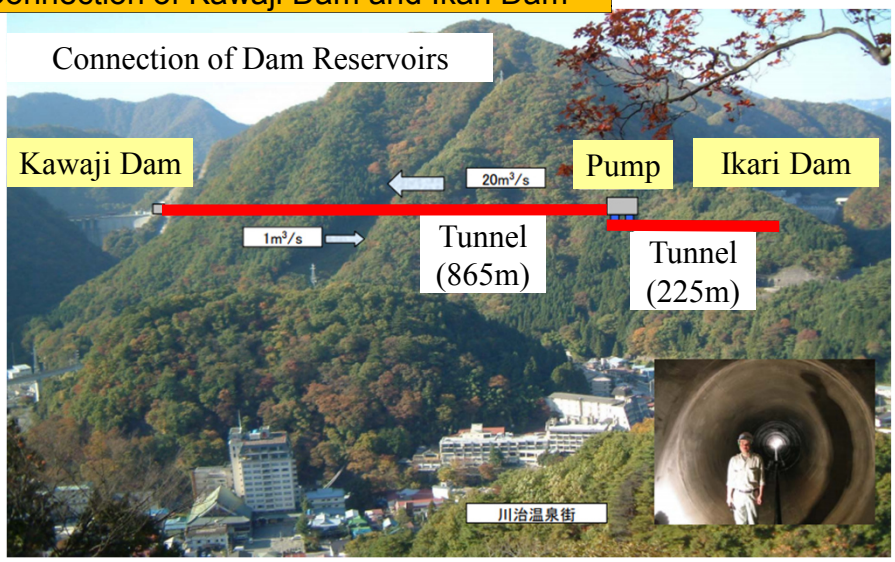
Networking of Dams / Connect Dam Reservoirs

Connection of Kawaji Dam and Ikari Dam



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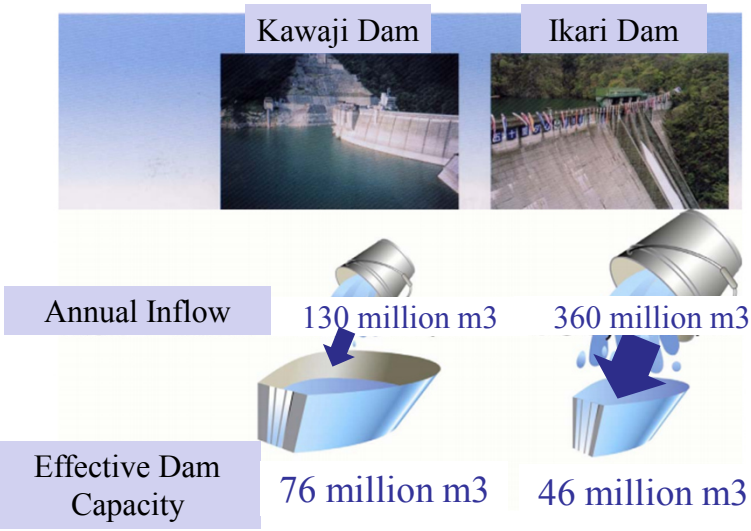
Networking of Dams / Connect Dam Reservoirs

Connection of Kawaji Dam and Ikari Dam



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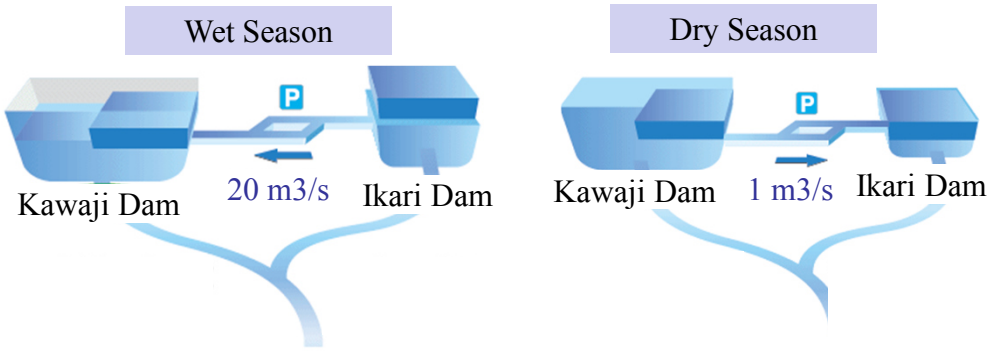
Networking of Dams / Connect Dam Reservoirs

Connection of Kawaji Dam and Ikari Dam



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Summary

- ✓ IWRM is needed by the Best Combination of Hard & Soft, Grey & Green Infrastructure.
- ✓ Dam is one of the Powerful Measures for IWRM.
- ✓ Existing Dams should be fully utilized by Dam Optimization.
- ✓ Dam Optimization can be considered from 4 View Points.
  - ❖ Use Dam as Long as Possible
  - ❖ Use Dam Capacity Effectively
  - ❖ Strengthen Dam Function
  - ❖ Networking of Dams

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Discussion

- ✓ What kind of needs on “Dam Optimization” are available at ADB?
- ✓ In which Region or Country, “Dam Optimization” is needed?
- ✓ For what Projects, “Dam Optimization” is applicable?

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ADB

Thank you
for your attention

Noriyuki MORI
nmori@adb.org

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